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**ENGLISH TRANSLATION OF
ANNEX TO INTERNATIONAL
PRELIMINARY EXAMINATION
REPORT (14 pp.)**

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DESCRIPTION

PAPERMAKING CHEMICAL, METHOD FOR MANUFACTURING SAME, AND
PAPER CONTAINING SAME

TECHNICAL FIELD

This invention relates to a papermaking chemical, a method for manufacturing this papermaking chemical, and paper containing the same, and more particularly relates to a papermaking chemical exhibiting an excellent paper strengthening effect, drainage improvement effect, retention improvement effect, plybond strength enhancing effect, surface strength enhancing effect, and sizing improvement effect in acid, neutral, or alkaline papermaking systems; a method for manufacturing a papermaking chemical containing a (meth)acrylamide polymer, with which this papermaking chemical can be formed; and paper that makes use of this (meth)acrylamide polymer and as a result has excellent bursting strength, internal bond strength, and other such properties.

BACKGROUND ART

Various kinds of papermaking chemicals have been used in the papermaking process in the past for the purpose of

raising productivity through higher machinery speed, or improving the paper quality. (Meth)acrylamide polymers are especially important chemicals in terms of improving paper quality and raising productivity, and as such these chemicals are being used in an increasingly wide range of applications and continue to be improved.

(Meth)acrylamide polymers are widely used as papermaking chemicals having a paper strengthening effect, drainage improvement effect, retention improvement effect, plybond strength enhancing effect, surface strength enhancing effect, sizing improvement effect, and so forth. From the standpoint of their ionicity, (meth)acrylamide polymers are classified into anionic, cationic, and amphoteric polymers. At first, anionic (meth)acrylamide polymers were used along with aluminum sulfate back in the 1960's. Then, in the 1970's and 80's, Mannich-modified (meth)acrylamide polymers, Hofmann-modified (meth)acrylamide polymers, and other such polymers into which cationic groups had been introduced came into use. However, aqueous solutions of these modified (meth)acrylamide...

...enhancing effect, and particularly its sizing improvement effect, as well as paper containing this papermaking chemical, a (meth)acrylamide polymer that is favorable for constituting this papermaking chemical, and a method for manufacturing this (meth)acrylamide polymer.

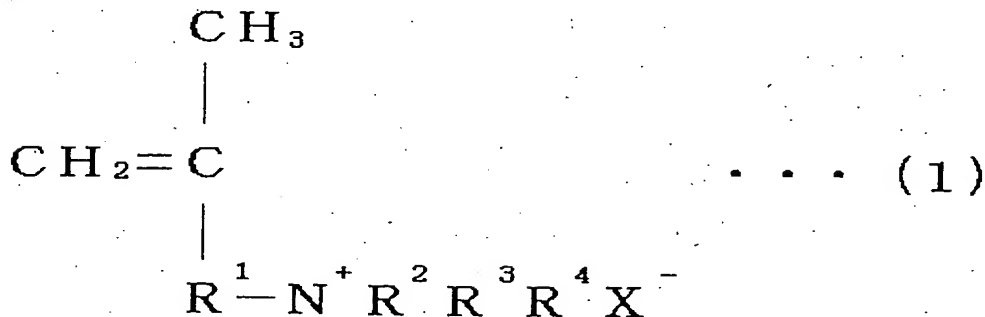
DISCLOSURE OF THE INVENTION

As a result of diligent research aimed at solving the above problems, the inventors arrived at the present invention upon discovering that a (meth)acrylamide polymer that can be used as a papermaking chemical with little unreacted monomer can be manufactured by using a tertiary or quaternary methallyl ammonium salt expressed by general formula 1 of the present invention as a monomer having the function of lowering the viscosity of a polymer, and that when a (meth)acrylamide polymer made from a tertiary or quaternary methallyl ammonium salt expressed by the following general formula 1 is used as a papermaking chemical, the resulting papermaking chemical has an excellent paper strengthening effect, drainage improvement effect, retention improvement effect, plybond strength enhancing effect, and surface strength enhancing effect, and particularly its sizing improvement effect.

Specifically, the present invention, which is the means for solving the above problems, provides:

(1) A papermaking chemical, containing a (meth)acrylamide polymer produced by polymerizing a monomer (a) expressed by the following general formula 1, the following monomer (b), and the following monomer (c):

(a) general formula 1



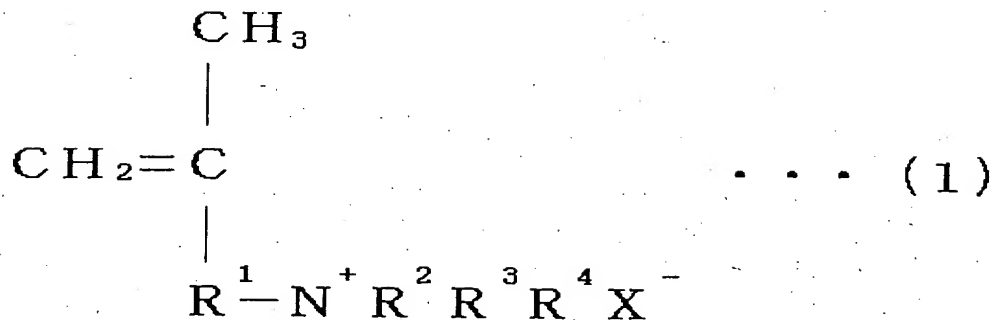
(where R¹ is a C₁ to C₄ alkylene group, R² to R⁴ are each a hydrogen atom or C₂₂ or lower alkyl group that may have a substituent (two or three of R² to R⁴ may not be hydrogen atoms), and X⁻ is an anion of an inorganic acid or an organic acid);

(b) a (meth)acrylamide;

(c) an ionic monomer other than monomer (a) expressed by general formula 1 above.

(2) A papermaking chemical, containing a (meth)acrylamide polymer produced by polymerizing a monomer (a) expressed by the following general formula 1, the following monomer (b), the following monomer (c), and a crosslinking agent (d):

(a) general formula 1



(where R^1 is a C_1 to C_4 alkylene group, R^2 to R^4 are each a hydrogen atom or C_{22} or lower alkyl group that may have a substituent (two or three of R^2 to R^4 may not be hydrogen atoms), and X^- is an anion of an inorganic acid or an organic acid);

(b) a (meth)acrylamide;

(c) an ionic monomer other than monomer (a) expressed by general formula 1 above.

(3) A method for manufacturing the papermaking chemical containing a (meth)acrylamide polymer according to (1) above, wherein at least one member selected from the group consisting of the monomer (a), monomer (b), and monomer (c) according to (1) above is polymerized, and the remaining monomers are added during this polymerization.

(4) A method for manufacturing the papermaking chemical containing a (meth)acrylamide polymer according to (2) above, wherein at least one member selected from the group consisting of the monomer (a), monomer (b), monomer (c), and crosslinking agent (d) according to (2) above is polymerized, and the remaining monomers are added during this polymerization.

(5) A papermaking chemical, containing a (meth)acrylamide polymer produced by polymerizing a monomer (a) expressed by the following general formula 1, the following monomer (b), the following monomer (c1), the following monomer (c2), and a crosslinking agent (d):

(a) general formula 1



(where R¹ is a C₁ to C₄ alkylene group, R² to R⁴ are each a hydrogen atom or C₂₂ or lower alkyl group that may have a substituent (two or three of R² to R⁴ may not be hydrogen atoms), and X⁻ is an anion of an inorganic acid or an anion of an organic acid);

(b) a (meth)acrylamide;

(c1) a (meth)allylsulfonic acid (salt);

(c2) an ionic monomer other than the monomer (a) and the monomer (c1).

(6) A method for manufacturing the papermaking chemical containing a (meth)acrylamide polymer according to (5) above, wherein at least one member selected from the group consisting of the monomer (a), monomer (b), monomer (c1), monomer (c2),

and crosslinking agent (d) according to (5) above is polymerized, and the remaining monomers are added during this polymerization.

(7) A papermaking chemical, containing the (meth)acrylamide polymer according to any one of (1), (2), and (5) above, produced by the polymerization in the presence of a urea compound (e).

(8) The method for manufacturing a papermaking chemical containing a (meth)acrylamide polymer according to any one of (3), (4), and (6) above, wherein the polymerization is conducted in the presence of a urea compound (e).

(9) A papermaking chemical, wherein the (meth)acrylamide polymer according to any one of (1), (2), (5), and (7) above is a paper strength agent.

(10) Paper containing the papermaking chemical according to (9) above.

BEST MODE FOR CARRYING OUT THE INVENTION

The monomer (a) used in the present invention is one of the compounds expressed by the following general formula 1. These may be used singly or in combinations of two or more types. Also, these may be used in the form of a powder or a solution.

(a) general formula 1

In the method for manufacturing a papermaking chemical containing a (meth)acrylamide polymer pertaining to the present invention that is characterized in that ..., from the standpoint of the properties of the papermaking chemical and the (meth)acrylamide polymer, monomers (A) may be monomers containing at least one component out of the various components of the above-mentioned monomer (a), monomer (b), and monomer (c), but it is particularly favorable for them to be monomers containing components of each of the above-mentioned monomer (a), monomer (b), and monomer (c). Monomers (B) may be monomers containing at least one component out of the various components of the above-mentioned monomer (a), monomer (b), and monomer (c), but it is particularly favorable for them to be monomers containing just the above-mentioned monomer (c) component, or a monomer containing components of each of the above-mentioned monomer (a), monomer (b), and monomer (c).

In the method for manufacturing a (meth)acrylamide polymer pertaining to the present invention that is characterized in that at least one member selected from the group consisting of the above-mentioned monomer (a), monomer (b), monomer (c), and crosslinking agent (d) is polymerized, and the remaining monomers are added during the polymerization, from the standpoint of the properties of the papermaking chemical and the (meth)acrylamide polymer, monomers (A) may be monomers containing at least one component out of the

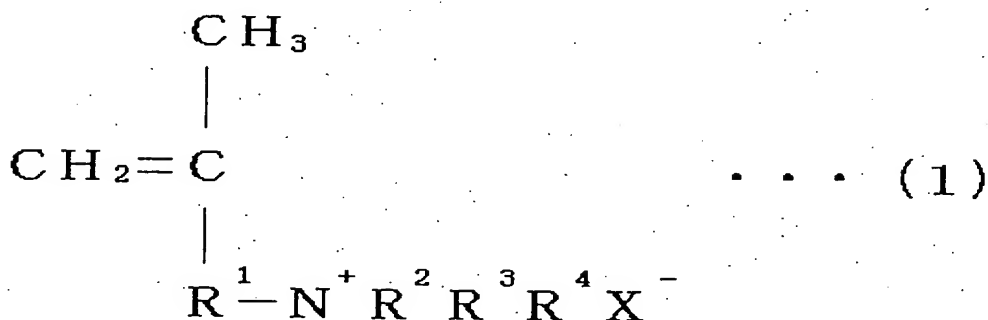
various components of the above-mentioned monomer (a), monomer (b), monomer (c), and crosslinking agent (d), but it is particularly favorable for them to be monomers containing components of each of the above-mentioned monomer (a), monomer (b), monomer (c), and crosslinking agent (d). Monomers (B) may be monomers containing at least one component out of the various components of the above-mentioned monomer (a), monomer (b), monomer (c), and crosslinking agent (d), but it is particularly favorable for it to be a monomer containing just the above-mentioned monomer (c) component, or a monomer containing components of each of the above-mentioned monomer (a), monomer (b), and monomer (c), or a monomer containing components of each of the above-mentioned monomer (a), monomer (b), monomer (c), and crosslinking agent (d).

In the method for manufacturing a (meth)acrylamide polymer pertaining to the present invention that is characterized in that at least one member selected from the group consisting of the above-mentioned monomer (a), monomer (b), monomer (c1), monomer (c2), and crosslinking agent (d) is polymerized, and the remaining monomers are added during the polymerization, ... the papermaking chemical and the (meth)a...

CLAIMS

1. (amended) A papermaking chemical containing a (meth)acrylamide polymer, produced by polymerizing a monomer (a) expressed by the following general formula 1, the following monomer (b), and the following monomer (c):

(a) general formula 1



(where R^1 is a C_1 to C_4 alkylene group, R^2 to R^4 are each a hydrogen atom or C_{22} or lower alkyl group that may have a substituent (two or three of R^2 to R^4 may not be hydrogen atoms), and X^- is an anion of an inorganic acid or an organic acid);

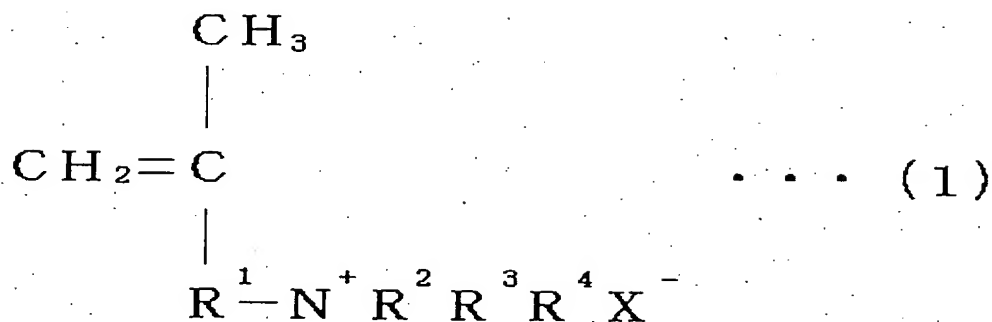
(b) a (meth)acrylamide;

(c) an ionic monomer other than monomer (a) expressed by general formula 1 above.

2. (amended) A papermaking chemical containing a (meth)acrylamide polymer, produced by polymerizing a monomer (a) expressed by the following general formula 1, the following monomer (b), the following monomer (c), and a

crosslinking agent (d):

(a) general formula 1



(where R^1 is a C_1 to C_4 alkylene group, R^2 to R^4 are each a hydrogen atom or C_{22} or lower alkyl group that may have a substituent (two or three of R^2 to R^4 may not be hydrogen atoms), and X^- is an anion of an inorganic acid or an organic acid);

(b) a (meth)acrylamide;

(c) an ionic monomer other than monomer (a) expressed by general formula 1 above.

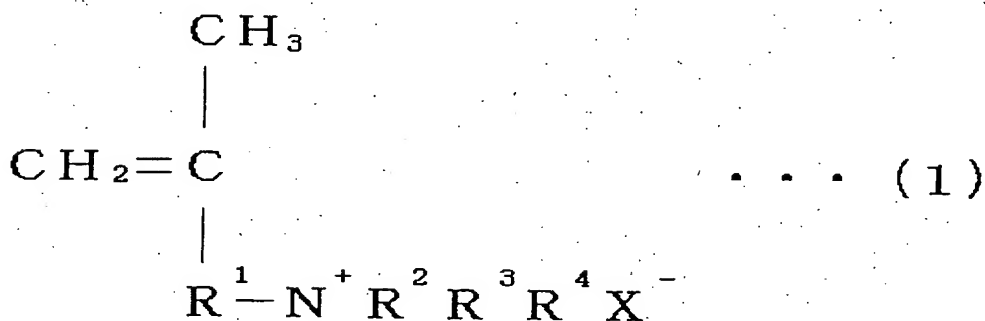
3. (amended) A method for manufacturing the papermaking chemical containing a (meth)acrylamide polymer according to Claim 1, wherein at least one member selected from the group consisting of the monomer (a), monomer (b), and monomer (c) according to Claim 1 is polymerized, and the remaining monomers are added during this polymerization.

4. (amended) A method for manufacturing the papermaking chemical containing a (meth)acrylamide polymer

according to Claim 2, wherein at least one member selected from the group consisting of the monomer (a), monomer (b), monomer (c), and crosslinking agent (d) according to Claim 2 is polymerized, and the remaining monomers are added during this polymerization.

5. (amended) A papermaking chemical, containing a (meth)acrylamide polymer produced by polymerizing a monomer (a) expressed by the following general formula 1, the following monomer (b), the following monomer (c1), the following monomer (c2), and a crosslinking agent (d):

(a) general formula 1



(where R¹ is a C₁ to C₄ alkylene group, R² to R⁴ are each a hydrogen atom or C₂₂ or lower alkyl group that may have a substituent (two or three of R² to R⁴ may not be hydrogen atoms), and X⁻ is an anion of an inorganic acid or an organic acid);

(b) a (meth)acrylamide;

(c1) a (meth)allylsulfonic acid (salt);

(c2) an ionic monomer other than the monomer (a) and

the monomer (c1).

6. (amended) A method for manufacturing the papermaking chemical containing a (meth)acrylamide polymer according to Claim 5, wherein at least one member selected from the group consisting of the monomer (a), monomer (b), monomer (c1), monomer (c2), and crosslinking agent (d) according to Claim 5 is polymerized, and the remaining monomers are added during this polymerization.

7. (amended) The papermaking chemical, containing a (meth)acrylamide polymer according to any one of Claims 1, 2, and 5, wherein the polymerization is conducted in the presence of a urea compound (e).

8. (amended) The method for manufacturing a papermaking chemical containing a (meth)acrylamide polymer according to any one of Claims 3, 4, and 6, wherein the polymerization is conducted in the presence of a urea compound (e).

9. (deleted)

10. (amended) A papermaking chemical, wherein the papermaking chemical containing a (meth)acrylamide polymer according to any one of 1, 2, 5, and 7 is a paper strength

agent.

11. (amended) Paper containing the papermaking chemical according to Claim 10.